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Inter-comparison of radiometric calibration of Terra and Aqua MODIS 11μm and 12 μm Bands

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ABSTRACT

Currently there are two Moderate Resolution Imaging Spectroradiometer (MODIS) instruments operating on-orbit, one on-board the NASA Earth Observing System (EOS) Terra spacecraft launched in December 1999 and the other on the EOS Aqua spacecraft launched in May 2002. Since its launch, each MODIS has been making continuous observations and producing calibrated data sets for the studies of the state of the Earth system and the changes of the global environment. MODIS 11μm and 12μm bands are primarily used for measuring the land and sea surface temperatures. These two bands have higher calibration accuracy requirements of 0.5% at specified typical radiance than most other thermal emissive bands (TEBs) of 1%. All the MODIS TEBs are calibrated on-orbit by an on-board calibrator blackbody (BB). To examine and verify the calibration consistency between Terra and Aqua MODIS in the thermal emissive bands, we have performed inter-comparison of MODIS 11μm and 12μm bands using closely matched thermal infrared (TIR) channels of the Advanced Very High Resolution Radiometer (AVHRR) onboard the NOAA-16 and NOAA-17. Our previous investigations only used the AVHRR LAC (local area coverage) data sets that have very limited availability. In this paper, we present our analysis of comparing the results from using LAC data sets and that from using the GAC (global area coverage) data sets. The use of GAC data sets provides more opportunities for the long-term trending analysis. Our results from August 2002 to July 2004 show that the measured temperature of Terra MODIS at 11μm and 12μm are about 0.20K higher than that from the Aqua MODIS at a brightness temperature range of 250 to 280K. Using the MODIS as an intermediate transfer reference, the results indicate that the 11μm and 12μm channels of the AVHRR on NOAA-16 are about 0.3K and 0.4K warmer than that on NOAA-17 in the same temperature range.

Keywords: MODIS, AVHRR, radiometer, thermal emissive band, inter-comparison, onboard calibration

1. INTRODUCTION

Inter-comparison of Earth-observing sensors' radiometric calibration is a crucial step that assures consistent data sets and various science products can be produced from the observations by different sensors for long-term studies of terrestrial, atmospheric, oceanographic, and climate changes. Sea surface temperature (SST) is one of the key parameters used to monitor global climate and environment changes, which are currently generated by the observations from a number of sensors, including the Moderate Resolution Imaging Spectroradiometer (MODIS) on-board the NASA Earth Observing System (EOS) Terra and Aqua spacecraft and the Advanced Very High Resolution Radiometer (AVHRR) onboard the NOAA-16 and NOAA-17. Inter-comparison between any two sensors, for the closely matched spectral bands or channels, can be made through their solar and lunar observations, simultaneous ground observations, or through filed campaigns (vicarious calibration and validation)[1-7].

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